Space Weather Forecast

Issued on Saturday, 11 May 2024 at 00:23 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G4 (Severe) Geomagnetic storms expected 11 May with likely peak G5 (Extreme) intervals. Further R3 (Strong flares) likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained high in the past 24 hours, with X-ray activity showing frequent Moderate-class activity, peaking with a Strong flare from the large region in the southwest. There are currently eight sunspot groups on the disc, with a previously large and complex region now no longer visible on the northwestern solar horizon. New regions appeared in the southeast disc, but as small features.

The region in the southwest is by far the largest and most complex region on the disc, as has been the case for recent days. It currently presents with the most complex magnetic classification possible. Although growth of the region has slowed, there has been consolidation of the broader penumbral area and notable relative movement between the various mixed polarity spots, presenting large magnetic shear and further potential for large flares. The remaining regions on the visible disc are much smaller and more magnetically simple.

The largest two flares on 10 May from the region in the southwest both resulted in CMEs that are Earth directed. The latter is much slower and awaiting analysis. The former is expected to arrive at Earth late on Day 1 (11 May) or early Day 2 (12 May). Another eruption from the south-centre disc does not appear to have resulted in an energetic CME.

Solar Wind / Geomagnetic Activity: Solar winds were at slightly elevated levels for much of the period, but increased following the passage of the first CME at 10/1639 UTC. Speeds jumped to strong levels, around 700km/s, with a further spike observed with the arrival of the second CME after 10/2139 UTC. Peak speeds of 804km/s (very strong) were observed at 10/2212 UTC. The Interplanetary Magnetic Field was at weak levels until the passage of both CMEs. Very strong values were recorded following both CME arrivals, the second being stronger. The important north-south component was weakly variable early on, but predominantly very strongly negative (southward) Bz following both CME arrivals.

The net result of the above solar wind measures was Quiet to Unsettled geomagnetic activity early in the period, increasing to G4/Severe (Kp8) between 10/1500-2100 UTC, then a G5/Extreme (Kp9) interval 10/2100-10/2400 UTC.

Energetic Particles / Solar Radiation: Solar radiation levels showed an upward trend in the wake of recent strong flares, rising to S2/Moderate storm levels at peak immediately following the first CME arrival on 10 May. Proton flux reduced to S1/Minor Storm levels thereafter.

Four-Day Space Weather Forecast Summary

Solar Activity: Further Strong flares are likely in the coming days with frequent Moderate flares expected, primarily from the large sunspot region in the southwest disc, but perhaps also contributed to from new eastern solar horizon arrivals.

Solar Wind / Geomagnetic Activity: Recent CME arrivals have significantly increased

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geomagnetic activity and solar wind speeds (strong) and further CMEs are expected to follow in the coming days. Two large flares from the large sunspot in the southwest disc on 09 May resulted in Earth-directed CMEs. The faster, second CME is forecast to merge with the preceding CME resulting in a combined front arriving late Day 1 (11 May) or early Day 2 (12 May). Another much slower CME was observed leaving the sun following another large flare of the same sunspot region on 10 May. This is awaiting analysis, but likely has an Earth-directed component, perhaps arriving at the end of the forecast period.

Coronal hole enhancements during the period are expected to be more muted compared to ongoing and forecast CME effects. A minor coronal hole enhancement is possible from late Day 1 (11 May) or early Day 2 (12 May), although this feature may well have opened too late for any arising fast wind to intersect the Earth, which would delay the inbound fast wind to the larger and more intense coronal hole later on Day 2 (12 May). A small coronal hole in the southern hemisphere may also connect with Earth in a similar timeframe.

Geomagnetic activity is expected to be at G4/Severe (Kp8) levels initially on Day 1 (11 May) with a chance of peak G5/Extreme storm conditions. Activity should erratically subside on Day 1 (11 May), but become enhanced again following the combined arrivals of the two CMEs late Day 1 (11 May), or more likely early Day 2 (12 May). Peak G2/Moderate storming is most likely, but with a chance of G3-G4/Strong-Severe levels of activity. Activity should further wane from later on Day 2 (12 May), with reduced risk probabilities on Days 3 and 4 (13 and 14 May), however confidence at the end of the period is low and the forecast may change should further large Earth-directed CMEs occur.

Energetic Particles / Solar Radiation: Solar radiation levels are at S1/Minor Storm levels and should be maintained into Day 1 (11 May) at least, with a somewhat uncertain decline projected in the absence of any further significant flaring from the large sunspot in the southwest disc. The region is, however, moving into a more favourable location for proton response in the coming days. There is a chance of S3/Strong or greater levels on Day 1 (11 May) reducing to a slight chance on the remaining days, although this could change following any further large flares from this region.

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Met Office Space Weather Forecast

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	100	95	50	30
Strong	G3	Yes	100	50	10	5
Severe	G4	Yes	95	30	5	1
Extreme	G5	Yes	50	5	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	95	95	95	95
Very Active	R3 to R5 X	Yes	60	50	50	50

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	100	80	60	40
Very Active	≥ S3 *	No	20	15	10	5

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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